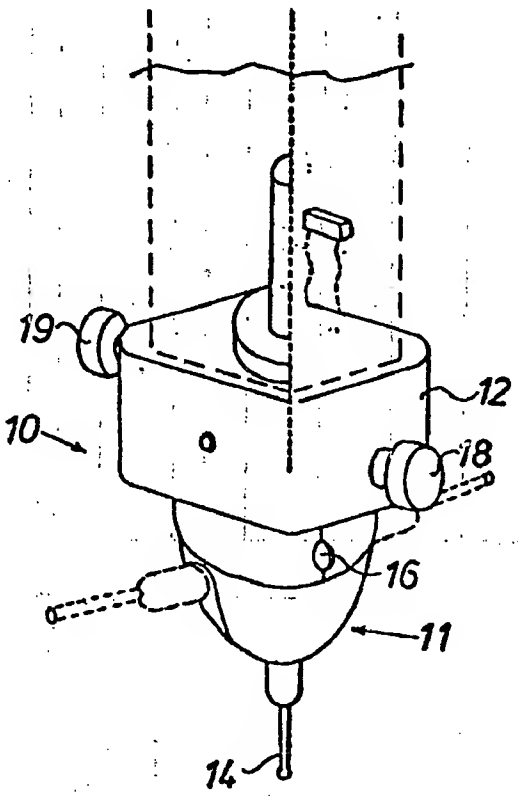
(12) UK Patent Application (19) GB (11) 2 037 436 A

(21) Application No 7934133
(22) Date of filing 2 Oct 1979
(30) Priority data
(31) 7838944
(32) 2 Oct 1978
(33) United Kingdom (GB)
(43) Application published
9 Jul 1980
(51) INT CL³
G01B 7/03 3/22
(52) Domestic classification
G1N 1A3A 1A6 3V2 3V7
4C 6A 7N AGA
G1M 1A2 1H 2F 2H
(56) Documents cited
GB 1517177
GB 1401034
GB 1386173
GB 1248065
GB 1135237
GB 818654
(58) Field of search
G1M
G1N
(71) Applicants
Haltronic Systems Limited, Lodge Works, Aston on Trent, Derby.
Notsa Engineering Company Limited, Lodge Works, Aston on Trent, Derby
(72) Inventors
Kenneth Potts,
Richard Land,
Peter Harper,
Terence Starkey,
Donald Wright
(74) Agents
Eric Potter & Clarkson

(54) Swivel probe

(57) A swivel probe, for use in conjunction with a coordinate measuring machine for determining the dimensions of an article, includes a probe stylus 14 movably mounted in a housing 11 so as to project beyond the walls of the housing, the housing 11 being rotatably mounted on a base 12, first drive means for moving the stylus 14 relative to the housing 11 and second drive means for rotating the housing 11 relative to the base 12, sensing means for sensing the position of the first and second drive means in order to determine the position of the stylus 14, the stylus being constructed so that it produces a signal to indicate when it contacts a surface of the article being measured.

Fig. 1



GB 2 037 436 A

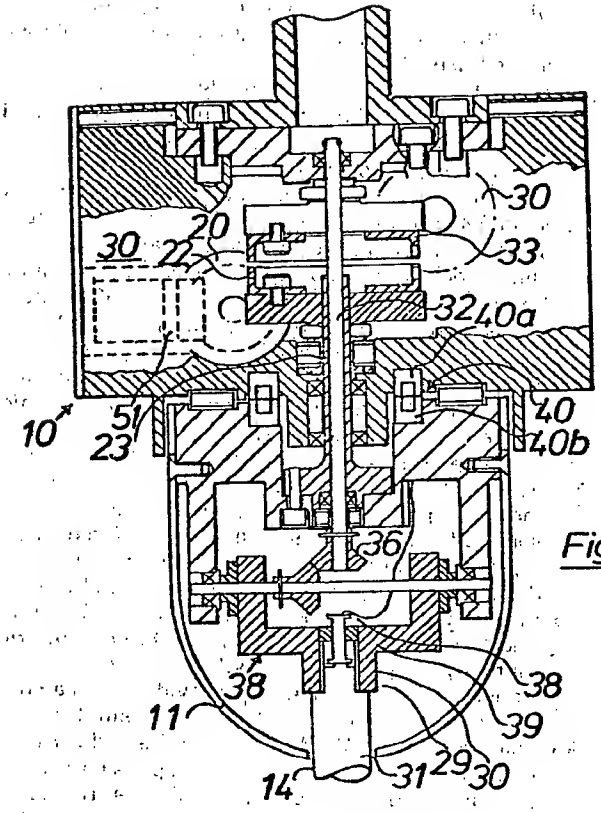


Fig.3

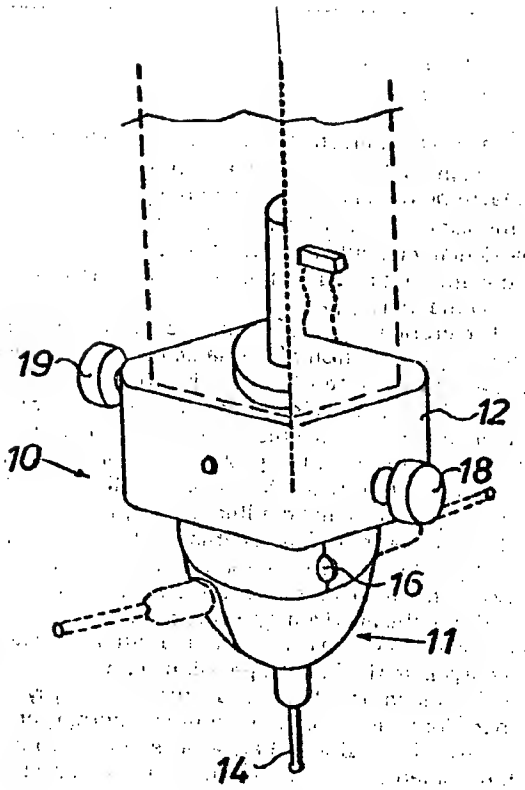


Fig. 1

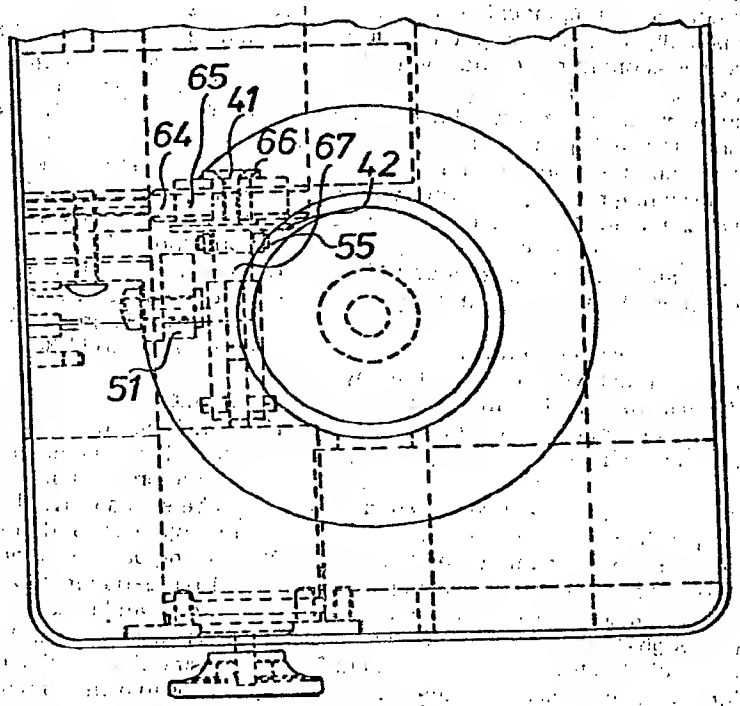


Fig. 2

SPECIFICATION

Swivel probe

The present invention relates to a swivel probe for use in conjunction with a co-ordinate measuring machine for determining the dimensions of an article. Such a probe is particularly useful in determining the measurements of large heavy articles such as heavy machinery parts.

The probe according to the present invention is basically an electronic/mechanical system, which allows measurements to be taken on a co-ordinate measuring machine irrespective of the position of the piece to be measured, relative to horizontal and vertical planes. The probe body can be rotated continuously through 360° in either direction and the tip or stylus can be 'tilted' through a total of 220°. These conditions enable the tip of the stylus to be positioned at any desired reference angle prior to the measurement sequence taking place.

The probe is driven by 2 stepper motors. One causes the body to rotate and the other causes the stylus to tilt. These operations can be performed in both the manual mode (by a joystich operation) and also under complete computer control. The position of either axis of the probe is determined by a readout/counter which provides a visual display, and also is capable of having data accessed from itself and through an interface presented to a computer. This facility enables the computer to drive the system to any given position and monitor its progress on the way. Once the probe has arrived at a preset reference position, the measuring operation can commence.

The co-ordinate measuring machine is then driven either manually or under computer control, until the probe stylus comes into contact with the part to be measured. At this instant, the probe generates a signal which causes the relative data of the measuring machine's position to be presented to the computer, and the main drive system of the measuring machine to stop, reverse direction, and back the probe stylus away from the part, to the preset position, before the next operation is commanded from the computer. The probe signal is derived from a pair of mutual coupled coils.

The field in one coil is collapsed when the stylus comes into contact with enything, thereby generating a logic signal, and initiating data access and motor drive inhibit conditions.

Reference is now made to the accompanying drawings, in which:—

Figure 1 shows a part perspective view of a probe according to the present invention.

Figures 2 and 3 show in greater detail the internal assembly of the probe shown in Figure 1.

The probe 10 has a head 11 which can rotate continuously through 360° and a base 12 which is intended to be fitted to the probe holder of our 3 axis measuring machine (called Maxicheck).

The head 11 houses a stylus 14, such as the angular deflection as shown in the Figure 1. A visual scale may be provided on the head 11 (visible through a window 16) for determining visually the rotary position of the head 11 relative to the base 12.

Knobs 18 and 19 are provided for manually adjusting either the rotary position of the head 11 or the angle of deflection of the stylus.

A first step motor 20 drives a worm gear 21 which in turn drives a worm wheel 22 secured to a shaft 23 extending into the probe head 11. The shaft 23 is secured to the head 11 and is supported by precision bearings. Thrust washers 25 are provided to steady the rotation of the head.

A second step motor 30 drives a shaft 32 through a worm gear and worm wheel 33. The end of shaft 32 housed in the head 11 carries a crown gear 36 in mesh with crown gear 37 which rotates a cradle 38 for deflecting the stylus 14.

In use pulses are supplied to the step motors to position the probe stylus prior to carrying out a measuring operation. The number of pulses supplied are counted so that the position of the stylus can be monitored. The stylus is then deflected until it touches the work piece being measured. Contact causes the stylus to deflect. The stylus is electrically connected to one of two mutually coupled coils 40 which act as a transformer. The coil 40*a* is provided with a small voltage, say 5 volts which induces a similar voltage in coil 40*b*. When the probe stylus makes contact the field of coil 40*b* collapses causing a similar collapse in the field of coil 40*a*. This latt r collapse is identified by a sensing circuit which is triggered enabling the information of the counted pulses to be 'read' by the computer thereby giving a measured reading. The stylus is deflected to other positions to give other measured readings and the computer gives a suitable readout.

The rotary position of the head and a predetermined position of the probe stylus is referenced by virtue of light sensing devices. Accordingly, a disc 50 having a cut out portion is provided on the drive shaft of each step motor (only motor 20 being shown), in order to give a 'rough' indication as to the reference position. The cut out in disc 50 is sensed by sensor 51. A finer indication is provided by cut outs 46 on the worm wheels 22 and 33.

CLAIMS

1. A swivel probe for use in conjunction with a co-ordinate measuring machine for d termining the dimensions of an article, the probe including probe stylus movably mounted in a housing so as to project b yond the walls of the housing, the housing being rotatably mounted on a base, first drive means for moving the stylus relative to the housing and second drive means for rotating the housing relative to the base, serving means for sensing the position of the first and second drive means in order to determine the position of the stylus, the stylus being constructed so that it

2. A swivel probe according to Claim 1 wherein the first and second drive means both comprise step motors and the sensing means is arranged to count the number of pulses supplied to each motor in moving the stylus from a predetermined reference position to contact the surface of the article in order to determine the position of the stylus when it contacts said surface.

3. A swivel probe according to Claim 2 wherein both step motors are provided with position sensing means which are operable to position ach step motor at a present reference position in order to position the stylus at said predetermined reference position.

4. A swivel probe according to Claim 3 wherein the position sensing means for each step motor includes a disc mounted on the drive shaft of the motor, the disc having a cut out portion and light sensing means located adjacent the disc and being capable of detecting the presence of the cut out portion.

5. A swivel probe according to Claim 4 wherein ach drive shaft is provided with a worm gear which drives worm wheel having a cut out portion, and further light sensing means being provided for sensing the presence of the cut out portion in the worm wheel.

6. A swivel probe according to any preceding Claim wherein a pair of mutually coupled coils are provided, one coil being mounted in the base and the other being mounted in the housing, the stylus being electrically connected to the coil mounted in the housing, the coil in the base being provided with a current voltage so as to generated a similar voltage in the coil in the housing, the stylus on touching the surface of the article causing the field of the coil mounted in the housing to collapse and thereby causes a similar collapse of the field of the coil mounted in the base to thereby provide a signal indicative of the stylus contacting said surface.

7. A swivel probe according to any preceding claim wherein the stylus is pivotally mounted in the housing and is deflectable through an angle of about 220°.

8. A swivel probe substantially as described with reference to and as illustrated in the accompanying drawings.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1980. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

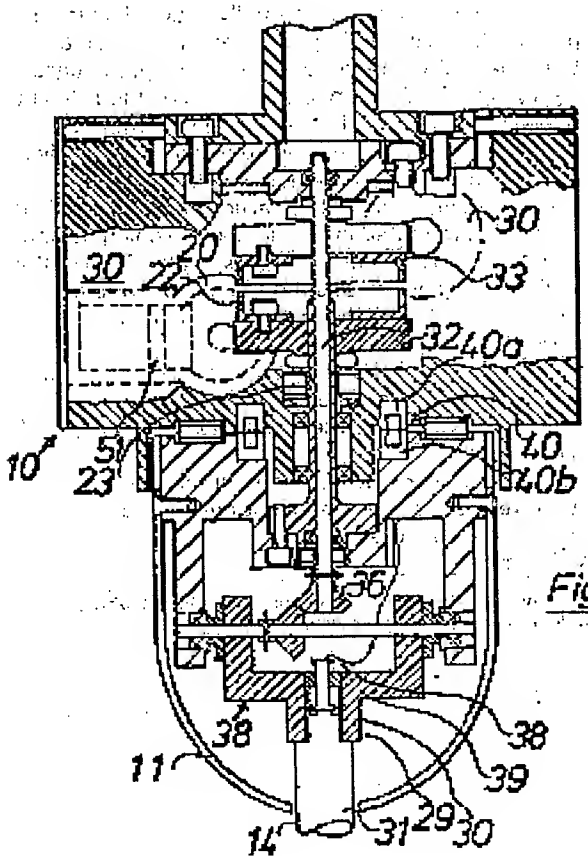


Fig. 3

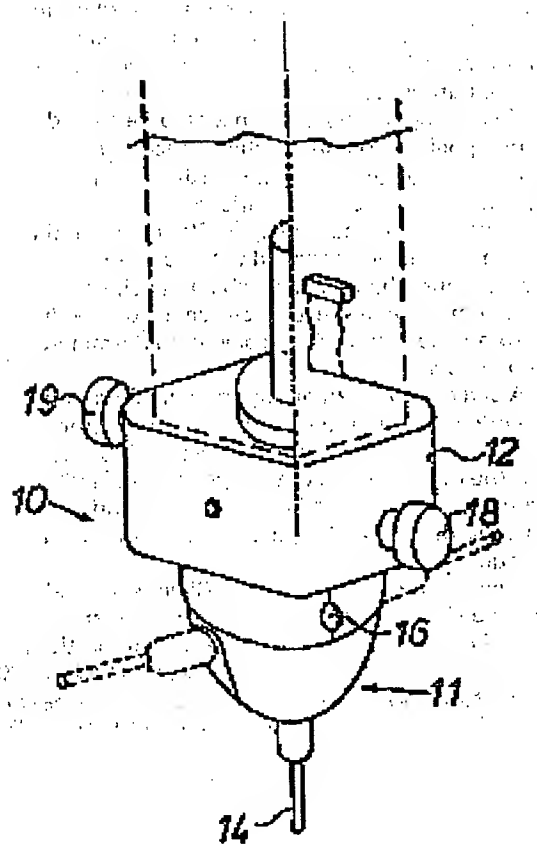


Fig. 1

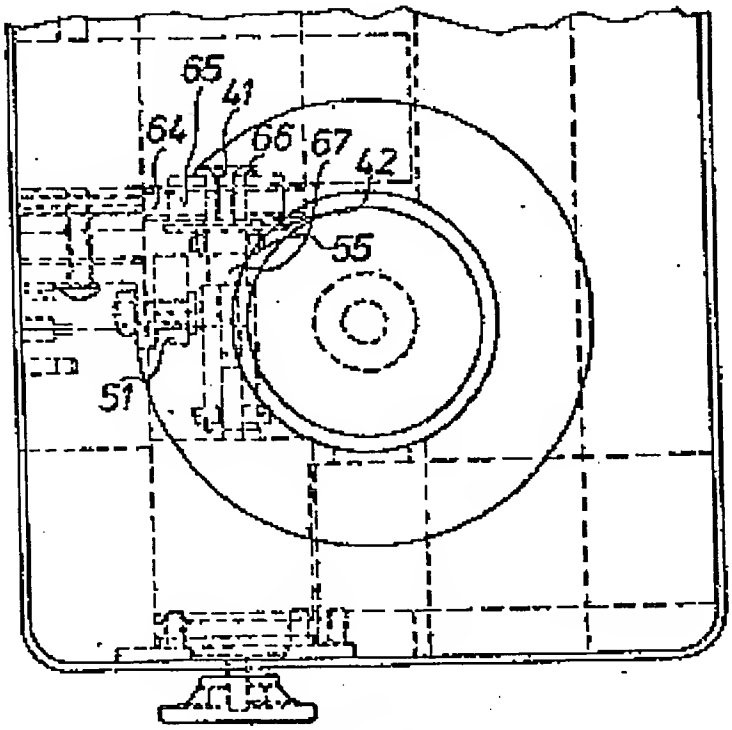


Fig. 2